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The 1991 Gordon Conference on Chronobiology was held at the Swabian Conference Center in Irsee, Germany, from September 29 to October 4, 1991. The possibility of holding the conference in Europe was known at the previous (1989) meeting, and conferees voted to do so if the opportunity materialized. Probably more than most, the field of chronobiology embraces many subdisciplines, ranging from molecular biology and genetics to physiology and ecology. It is also diverse in terms of biological material, including all Kingdoms and spanning the phylogenetic spectrum. It is relevant to many specific missions, such as medicine and pharmacology, agriculture and insect control, as well as marine biology and oceanography. The program (attached) thus reflects the wish and the willingness of workers in this area to consider a diversity of functions and a diversity of systems, ranging from nitrogen fixation in bacteria, photosynthesis and luminescence in marine dino-flagellates and CAB gene expression in wheat, to conidiation in Neurospora, eclosion in Drosophila, and activity in rodents and man.

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# 1991 GORDON CONFERENCE ON CHRONOBIOLOGY

## FINAL REPORT

United States Air Force

J. Woodland Hastings  
Chairman, Conference on Chronobiology

The 1991 Gordon Conference on Chronobiology was held at the Swabian Conference Center in Irsee, Germany, from September 29 to October 4, 1991. The possibility of holding the conference in Europe was known at the previous (1989) meeting, and conferees voted to do so if the opportunity materialized.

Such a move was particularly appropriate in the field of Chronobiology; research activity in this area is strong in Europe, particularly in Germany, the UK, Netherlands and Switzerland.

The conference was at first considerably oversubscribed, but additional accommodations obtained a few weeks prior to the conference permitted about 140 participants to attend. Of these, 65 were from the USA, Canada and Mexico, 30 from Germany, 9 each from the Netherlands and the UK, and the remaining 20 from 10 other countries. Some 38 of the attendees were women; 11 of these were on the program. (In the end, fewer than 10 applicants could not be accommodated)

Probably more than most, the field of chronobiology embraces many subdisciplines, ranging from molecular biology and genetics to physiology and ecology. It is also diverse in terms of biological material, including all Kingdoms and spanning the phylogenetic spectrum. It is relevant to many specific missions, such as medicine and pharmacology, agriculture and insect control, as well as marine biology and oceanography.

How can such a diversity of subjects and scientists be united to address the true frontiers of a subject? In my opinion, it can be attributed to the fact that the biological clock is pervasive both in terms of organisms and functional processes, and that it is of functional importance in very different fields and problems. Yet its fundamental mechanism, even in the most general terms, remains unknown. Thus, researchers find themselves united in the search for the mechanism, a very dynamic activity that respects no conventional borders.

The program (attached) thus reflects the wish and the willingness of workers in this area to consider a diversity of functions and a diversity of systems, ranging from nitrogen fixation in bacteria, photosynthesis and luminescence in marine dinoflagellates and CAB gene expression in wheat, to conidiation in *Neurospora*, eclosion in *Drosophila*, and activity in rodents and man.

The first day focussed on clock genes and clock regulation of gene expression at both transcriptional and translational levels. Evidence was presented that the product of the period gene in *Drosophila* can regulate the expression of that gene, the first direct evidence for such a loop. Circadian control of transcription in *Neurospora* was described, and the involvement of the phytochrome system in this step was shown for higher plants.

The second day was concerned first with non photic effects on the clock, exploring avenues related to the recent discovery that the circadian clock can be reset by physical activity. A second session was concerned with non circadian oscillations, especially with higher frequency rhythms and how they might serve as models for the circadian clock.

The third day was concerned with vertebrate rhythms, with emphasis on the role of the suprachiasmatic nuclei in the brain, whose lesion or removal results in the loss of rhythmicity. Several new discoveries in this area were reported.

Day four dealt first with studies of human clocks, an area that has received considerable attention in recent years. Interested as we all are in sleep (and jet lag), this area of study involves both basic and applied aspects. In the latter category, for example, is the role of the clock in seasonal affective disorder (SAD). A second session dealt with photoperiodism in both plants and animals; this also has both basic and applied aspects, the latter related to the control of reproduction. The postulate that it necessarily involves the circadian clock came into question. Heresy!

The final session dealt mostly with endogenous rhythms having tidal, lunar or annual periods. Little is known as yet as to how these are generated in the organism, but it seems clear that it is endogenous, since they will continue in the absence of the particular environmental cycle.

Poster sessions were organized by the Vice-chair of the conference. About 90 were contributed. These were organized into three sessions, held on Monday, Wednesday and Thursday afternoons. They constituted an unusually valuable component of the conference and allowed participants to get both an overview and detailed information concerning many different research programs.

The attendees expressed approval of the fact that the conference was held in Germany. This, it was felt, provided recognition of the reality that science and research is truly international in character, and that important ideas and experimental advances are not related to national boundaries. With 16 countries represented, the conference was indeed international in character.

In spite of the magnificent ambiance and facilities provided by the conference center, the attendees voted unanimously to return two years hence to the more pristine accommodations provided by the summer Gordon conferences in the USA. The very argument that led the participants to vote to hold this conference in Germany compelled them to rotate back to the US in 1993. But they also made the explicit request that the 1995 conference return to Europe.

Gordon Conference on Chronobiology 1991  
Irsee, Germany/September 29 - October 4  
(J. Woodland Hastings, Chairman)

Vice Chairman - William Schwartz  
Coordinator - Ebo Gwinner

MONDAY, September 30

AM SESSION (A)

Topic: Clock Control of Genome Expression

Discussion Leader: Ludger Rensing (Bremen)

Speakers: Steve Kay (Rockefeller) "Circadian regulated transcription in a *Arabidopsis thaliana*"  
Jennifer Loros (Dartmouth) "Clock controlled genes in *Neurospora crassa*"  
Klaus Kloppstech (Hannover) "Photomorphogenesis and circadian rhythmicity of gene expression: are they related?"

Discussants: Steve Sczekan (Harvard)  
Jeff Hall (Brandeis)  
Russ Van Gelder (Stanford)

PM SESSION (B)

Topic: Clock Genes and Clock Expression

Discussion Leader: Ferenc Nagy (Basel/Szeged)

Speakers: Michael Rosbash (Brandeis) "Dissection of spatial and temporal elements of the *period* genes expression within the *Drosophila* brain and within a given day"  
Joe Takahashi (Evanston) "Macromolecular synthesis and the regulation of circadian rhythms"

Discussants: Michael Young (Rockefeller) "New clock mutants in *Drosophila*"  
Jay Dunlap (Dartmouth)  
Arnold Eskin (Houston)

TUESDAY, October 1

AM SESSION (C)

Topic: Nonphotic Effects and Clock Organization

Discussion Leader: Gunther Fleissner (Frankfurt)

Speaker: Dale Edgar (Stanford) "Activity-dependent feedback to the mouse circadian pacemaker: assessment of exercise zeitgeber strength"  
Vincent Cassone (College Station) "Melatonin, the pineal gland and vertebrate circadian rhythms: from Zeitgeber to recursive feedback"  
Nicolas Mrosovsky (Toronto) "Interactions between non-photic and photic phase shifting stimuli: double pulse and other experiments"

Discussants: Serge Daan (Groningen)  
Fred Turek (Evanston)  
Larry Morin (Stony Brook)

PM SESSION (D)

Topic: Non Circadian Oscillations

Discussion Leader: Gene Block (Charlottesville)

Speakers: C.P. (Bambos) Kyriacou (Leicester) "Molecular control of *Drosophila* lovesong cycles"  
W. Engelmann (Tubingen) "Ultradian leaflet movement rhythm in *Desmodium*"

Discussants: David Lloyd (Cardiff)  
Maurice Stupfel (INSERM, Le Vésinet)  
Fred Kippert (Tubingen)

Irsee, Germany/September 29 - October 4  
(J. Woodland Hastings, Chairman)

WEDNESDAY, October 2

AM SESSION (E)

Topic: Vertebrate Rhythms I

Discussion Leader: Fred Davis (Boston)

Speakers: Rae Silver (New York) "What the SCN graft tells the host brain"  
Johanna H. Meijer (Leiden) "Physiological basis for photic entrainment"  
Martin Ralph (Toronto) "Expression of tau phenotypes following suprachiasmatic transplantation"

Discussants: Robert Moore (Pittsburgh)  
Pat De Coursey (South Carolina)

PM SESSION (F)

Topic: Vertebrate Rhythms II

Discussion Leader: W.J. Rietveld (Leiden)

Speakers: William Schwartz (U. Mass, Worcester) "Expression of AP-1 transcriptional regulatory proteins in the rat suprachiasmatic nucleus"  
Martha Gillette (Urbana, IL) "Analysis of phase-locked regulators of circadian rhythms in the SCN brain slice"  
Majib Mirmiran (Amsterdam) "Electrophysiological and microiontophoretic studies of the long-term cultured suprachiasmatic nucleus"

Discussants: Björn Lemmer (Frankfurt)  
Martin Zatz (Bethesda)  
Shin-Ichi Inouye (Tokyo)

THURSDAY, October 3

AM SESSION (G)

Topic: Endocrine and Non-endocrine Markers of Human Circadian Clocks

Discussion Leader: Anna Wirz-Justice (Basel)

Speakers: Eve Van Cauter (Brussels/Chicago) "Rates and mechanisms of adaptation to shifts of the sleep-wake and dark-light cycles"  
Charles Czeisler (Harvard Med Sch) "The human circadian multioscillator system revisited: multiple endocrine rhythms remain coupled to temperature following light induced phase shifts"

Discussants: Josephine Arendt (Surrey, U.K.) "Melatonin in human physiology and pathology"  
G. Brabant (Hannover)  
Michael Menaker (Charlottesville)

**BANQUET:** To Honor Professor Jürgen Aschoff

Master of Ceremonies: J. Woodland Hastings; Remarks: Till Roenneberg, Sato Honma

PM SESSION (H)

Topic: Clocks and Photoperiodism. A session in tribute to the late Professor Erwin Bünning (1906-1990)

Discussion Leader: M.K. Chandrashakaran (Madurai, India)

Speaker: David Saunders (Edinburgh) "Ovarian diapause regulation in *Drosophila melanogaster* is governed by a circadian photoperiod clock, but does not seem to involve the *period* gene"

Discussant: Edgar Wagner (Freiburg)  
Pekka Lankinen (Oulu, Finland)

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FRIDAY, October 4

AM SESSION (I)

Topic: Circannual and Circalunar Rhythms

Discussion Leader: Brian K. Follett (Bristol)

Speakers: Eberhard Gwinner (Erling-Andechs) "Avian circannual rhythms: mechanisms and functions"

Dietrich Neumann (Köln) "Circa-semilunar and circalunar programming of development in a marine insect"

Robyn Hudson (Munich) "Reproductive specializations in the female rabbit: chronobiological consequences"

Discussants: Niall Bromage (Univ. of Stirling)

Elena Thomas (Berkeley)

Fred Karsch (Ann Arbor)

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